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Title	An Evaluation of the Enterprise Reform in China: Income Share of Labor and Profitability in the Machine Industry
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Citation	Hitotsubashi Journal of Economics, 36(2): 125-143
Issue Date	1995-12
Type	Departmental Bulletin Paper
Text Version	publisher
URL	http://hdl.handle.net/10086/7762
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AN EVALUATION OF THE ENTERPRISE REFORM IN CHINA: INCOME SHARE OF LABOR AND PROFITABILITY IN THE MACHINE INDUSTRY

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Abstract

As for the economic reforms in China since 1978, some scholars claim the existence of profit maximization behaviors of enterprises and that of competitive labor markets, while others are suspicious about the result of economic reforms.

This paper provides a case study for machine industry in China as a whole for 1980-85 and in Tianjin for 1985-90. Firstly, we carefully estimate workers' cash incomes and various non-cash incomes to obtain relative share of labor. Secondly, we estimate production function to get output elasticity of labor. Finally, by comparing the labor's share and the output elasticity, we show that the former increased rapidly as the reform programs were implemented and exceeded the latter in 1988. Our estimate indicates that the incentive wage systems introduced in the mid-1980s allocated a large portion of profits to wages and increased the labor's share significantly.

Introduction

The economic reforms in China which have been promoted intensively since 1978 entered into the next and substantial stage by the decision of the full-scale introduction of market economy in the 14th Annual Meeting of the Chinese Communist Party in the fall of 1992. It has been revealed, however, that these reforms are not free from many problems.

One of the most important problem is that the enterprise reform, a key to the economic reforms, does not seem to be successful. In the state-owned enterprises, a core of industrialization in the socialistic country, labor productivity increase can not keep up with wage increases. Consequently the rate of profit to total capital decreased dramatically from 14.9% in 1984 to 3.3% in 1992¹. At the end of June 1994, 46.3% of state-owned enterprises were in deficit operation², and their losses were being subsidized by the government to avoid bankruptcy. Also large and medium-sized collectively-owned enterprises are believed to be in a similar situation³. It is well known, on the other hand, that other types of enterprises such as foreign enterprises, foreign-domestic joint ventures, individual firms, and township enterprises, especially township enterprises in the coastal regions, show spectacular growth and can be

¹ State Statistics Bureau 1993, p. 430.

² Sone and Li 1994, p. 71.

³ Collectively-owned enterprises include the enterprises operated by towns and villages (a part of so-called township enterprises).

considered eventually as an engine of the national economic growth.

This paper aims at evaluating the result of enterprise reform in the machine industry, considering a big role of this industry in the industrialization process. In more concrete terms, this paper intends to make exact estimation of the relative income share of labor and the output elasticity of labor and to make comparison between the two estimates. By this study, we will find that the relative income share of labor has increased much faster than and exceeded the output elasticity of labor (wages have increased much faster than and exceeded labor productivity) in this industry and will conclude that the new system of wage determination or the link of wage determination to profit which was employed to stimulate work incentives of managers and workers has accelerated wage increases, but not labor productivity improvement. (Market economy is characterized with equality between wages and labor productivity or the equality between labor share in income and output elasticity of labor.)

Before starting estimation we must make clarification about two problems. The first is concerned with definition or content of wage payments. In China especially in state-owned enterprises, the amount of payments in kind including benefit from utilizing houses and welfare facilities is large. In the already published estimates of labor share of income, this part of wages is neglected (it is defined as a ratio of cash payments to value added) and they underestimate the labor share substantially. On the other hand, in this paper, we will get more exact estimates of the labor share by means of estimating other components of wages in addition to cash payments.

The second is concerned with definition of enterprise's activities which are included in the estimation. As is well known, Chinese enterprises especially large-scale state-owned enterprises have all kinds of welfare facilities which are needed for daily life of workers and the workers who are in charge of managing and maintaining these facilities. They include living accommodations, culture and entertainment facilities, nursery schools, kindergartens, primary and secondary schools, college and universities, guards, janitors and so forth. In short, these respective big enterprises form their own society⁴. There are three alternative estimations:

1) Estimation A: Both in wage payments (numerator of the labor share) and value added (denominator) exclude non-production activities and include only manufacturing activities⁵. Because manufacturing activities and non-manufacturing activities involve completely different technology, however, we cannot estimate meaningful production functions by combining these activities together. Thus, estimation of production function will be restricted to manufacturing activities, and therefore the estimates of output elasticity of labor can be compared to labor share of income only in this case.

2) Estimation B: Both in numerator and in denominator non-manufacturing activities or service production are included. That is, numerator includes wage payments to workers in non-production activities, and denominator includes services and/or benefits coming from utilizing these facilities. The idea is that, without these facilities and their workers, daily life of production workers is impossible⁶. This estimation is theoretically ideal but practically problematical, because classification between production and non-production activities in assets and workers is sometimes ambiguous and arbitrary. For instance, on occasion, non-production

⁴ For details see Kizaki 1988.

⁵ Almost all of the estimation cited in Table 4 depend on this method.

⁶ For instance, Woo, Hai, Jin and Fan 1993.

workers transport production materials by vehicles for non-production activities.

3) Estimation C: This is a mixture of the two estimations; numerator includes wage payments for non-production workers and denominator is limited to manufacturing production. This estimation seems to be halfway, but should be realistic from a view of enterprise management, because their revenue comes from manufacturing production and wage costs include wage payments to non-production activities. It is almost impossible to say which is the best estimation among the above three alternatives: all of the three estimations have merits and demerits. Thus we will estimate relative income share of labor in the three ways and make a comparison of the result with the estimate of output elasticity of labor in case of A.

In estimation two sets of statistics are utilized. The first is statistics for the machine industry in 1980 and 1985, which is available from the 1985 *National Manufacturing Census* (*National Census* in short).⁷ The second is result of the sample survey on the machine industry in Tianjin which was carried out in 1991 and 1992 by ourselves: jointly by Japanese scholars mainly in the Nippon University and the Hitotsubashi University and Chinese scholars in the Tianjin Institute of the China Academy of Management Science. This survey (*Tianjin Survey* in short)⁸ consists of two surveys; main survey and sub-survey.

Main survey was done for 150 enterprises, which were selected from all machine manufacturing enterprises in Tianjin by random sampling method⁹. This includes main economic indicators for respective enterprises (value of production, value of capital, number of laborers and so forth) for every year of 1985–1990 and several indicators relating with productivity (education and working career of laborers, length of time of utilizing capital assets, R&D expenditures, sources of technology transfer and so forth) in 1990. This survey was conducted very carefully through close communications between enterprises and professional investigators of this city. The sub-survey was an interview for managers and workers concerning their working consciousness in the selected six enterprises¹⁰.

Actually only enterprises which existed for all years of the period in each of the two sets of statistics will be used. They are 129 and 389 in *Tianjin Survey* and *National Census*, respectively¹¹. This kind of panel data is appropriate to our analysis in that this is free from influences occurring from new entry and retirement of samples.

Estimation of relative income share of labor and that of output elasticity of labor are carried out respectively in Sections 1 and 2. In Section 3, we will make a comparison between the two estimates (relative income share of labor and output elasticity of labor) and will try to evaluate the result of the above mentioned incentive system. Section 4 is for summary and conclusions.

⁷ Committee of National Manufacturing Census, State Council 1987.

⁸ Survey results have not been published, but a proceeding of the workshop which was based on the results was published by the Faculty of Commerce, Nippon University in 1993.

⁹ For details, out of 150 enterprises 140 were randomly selected, and 10 were selected arbitrarily as the representative firms in Tianjin by the Tianjin Institute, China Academy of Management Science. The 140 enterprises were classified by the scale and by the type of ownership in advance, and in each group samples were selected in the random sampling method.

¹⁰ A study depending on the result of this survey was published by Kiyokawa 1994.

¹¹ Comparing these two sets of surveys with each other, *Tianjin Survey* is much closer to the real industrial structure than *National Census* which does not cover small firms. In this connection small firms with less than 1,000 workers are only 34 in the latter (389 samples in total) and 89 in the former (129 samples in total). All variables used in this study are averages of selected sample firms, not total. This is because if we use total figures, results of the study are largely influenced by large firms.

I. *Estimation of Relative Income Share of Labor*

Framework of Estimation

Expressing manufacturing activities (machine production in this case) and non-production activities (providing services of housing and all kinds of welfare facilities to workers) by subscripts p and n respectively, we have the following relations about net value added Y and total wage payments W .

$$\begin{aligned} Y &= Y_p + Y_n \\ W &= W_p + W_n \end{aligned}$$

Y can be known from the statistical sources, but Y_n is obtained later as W_n .

Total wage payments are consisted of three parts.¹² The first is wages paid in cash, which are consisted of (1) basic wages and piece-work payments and (2) bonuses, compensations, overtime payments, and additional wages and so forth. The second is welfare payments in cash, which are accident insurance, medical care, pensions and so forth. The third is benefits coming from utilizing various kinds of facilities such as houses, culture and entertainment facilities, nursery, and kindergartens. These three groups of wages are expressed by subscripts 1, 2, and 3, respectively. Here we have

$$\begin{aligned} W &= W_1 + W_2 + W_3 \\ W_p &= W_{p1} + W_{p2} + W_{p3} \end{aligned}$$

Relative income share of labor is defined as a ratio of total wage payments to value added. We have

$$\begin{aligned} \frac{W_p}{Y_p} &= \frac{W_{p1}}{Y_p} + \frac{W_{p2}}{Y_p} + \frac{W_{p3}}{Y_p} && \text{Estimation A} \\ \frac{W}{Y} &= \frac{W_1}{Y} + \frac{W_2}{Y} + \frac{W_3}{Y} && \text{Estimation B} \\ \frac{W}{Y_p} &= \frac{W_1}{Y_p} + \frac{W_2}{Y_p} + \frac{W_3}{Y_p} && \text{Estimation C} \end{aligned}$$

Estimates of all components of the labor's share (right-hand side in the above equations) and of their totals (labor's share) are given in Table 1.

Estimation of W_1 and W_{p1}

Cash wage payments W_1 and W_{p1} are obtained by multiplying per capita wages w to total number of workers L and that of production workers L_p respectively.

¹² Kojima 1988, p. 41.

TABLE 1. LABOR SHARE AND OUTPUT ELASTICITY OF LABOR:
THE MACHINE INDUSTRY

Type of estimation	Area	Year	Labor share				Output elasticity α
			$\frac{W_{p1}}{Y_p}$	$\frac{W_{p2}}{Y_p}$	$\frac{W_{p3}}{Y_p}$	$\frac{W_p}{Y_p}$	
Estimation A	China	1980	.303	.057	.154	.514	.536
		1985	.218	.056	.097	.371	.487
	Tianjin	1985	.257	.062	.042	.361	.550
		1986	.307	.078	.049	.434	.479
		1987	.378	.102	.068	.548	.576
		1988	.392	.111	.058	.561	.498
		1989	.398	.117	.045	.560	.488
		1990	.486	.155	.045	.686	.430
Estimation B	Area	Year	$\frac{W_1}{Y}$	$\frac{W_2}{Y}$	$\frac{W_3}{Y}$	$\frac{W}{Y}$	
	China	1980	.288	.055	.134	.477	
		1985	.229	.059	.098	.386	
	Tianjin	1985	.261	.063	.043	.367	
		1986	.307	.078	.047	.432	
		1987	.358	.097	.059	.514	
		1988	.386	.109	.055	.550	
		1989	.401	.117	.046	.564	
		1990	.489	.155	.046	.690	
Estimation C	Area	Year	$\frac{W_1}{Y_p}$	$\frac{W_2}{Y_p}$	$\frac{W_3}{Y_p}$	$\frac{W}{Y_p}$	
	China	1980	.369	.070	.190	.629	
		1985	.266	.069	.120	.455	
	Tianjin	1985	.277	.066	.047	.390	
		1986	.333	.084	.055	.472	
		1987	.413	.112	.077	.602	
		1988	.426	.120	.066	.612	
		1989	.429	.126	.050	.605	
		1990	.525	.167	.050	.742	

Sources: The labor shares are estimated from *National Census* and *Tianjin Survey*. The output elasticities of labor are from Table 3.

Estimation of W_2 and W_{p2}

From the *Statistical Yearbook of China*, the data for welfare payments and cash wages are available. According to them, a ratio of the former to the latter showed a rapidly increasing trend both in state-owned enterprises and collectively-owned enterprises in the 1980s; it climbed from 18% in 1980 to 32% in 1990 in the case of all enterprises (Table 2). Multiplying this ratio to W_1 and W_{p1} obtained from *National Census* and *Tianjin Survey*, we get W_2 and W_{p2} respectively.

TABLE 2. THE RATIO OF WELFARE EXPENDITURE TO WAGES PAID IN CASH IN ENTERPRISES (%)

Year	State-owned	Collective-owned	Average
1980	18.9	11.7	17.7
1985	25.8	18.3	24.0
1986	26.7	20.4	25.3
1987	28.5	22.0	27.0
1988	29.7	22.7	28.2
1989	31.0	23.8	29.3
1990	33.7	26.3	31.8

Source: State Statistical Bureau 1993, p. 815.

Estimation of W_3 and W_{p3}

Benefits from using all kinds of welfare facilities including houses are measured as a total of (1) depreciations of these facilities and their opportunity cost (profits obtained from investing the same amount of money to other purposes), and (2) total wage payments to workers engaging in management and maintenance of these facilities. Denoting amount of fixed non-production assets by K_n , rate of depreciation by d , rate of opportunity cost of capital by r , wage rate by w , the number of non-production workers by L_n and the total number of workers by L ($= L_p + L_n$), we have the following relations¹³

$$W_{p3} = [(d+r)K_n + wL_n] \left(\frac{L_p}{L} \right) \quad \text{for Estimation A}$$

$$W_3 = (d+r)K_n + wL_n \quad \text{for Estimation B and C}$$

Assuming a life of non-production assets as 50 years, rate d becomes 2%. Rate r is assumed to be equal to the rate of profits to fixed capital in state-owned enterprises in all manufacturing industries in China. This rate demonstrated a surprisingly large decline from 23.2% to 4.8 between 1980 and 1990¹⁴.

Results of Estimations

Comparing the labor share between China and Tianjin, one may see it is much larger in the former. In case of Estimation C (W/Y_p), for instance, it is 45.5% and 39.0% respectively.

¹³ This method is usually employed in the project evaluation (eg. Harberger 1972, pp. 132-156). There are a couple of estimates for housing services. Subsidies for housing rent for urban workers in 1988 was estimated by Khan as 334 Yuan per year (1992). Housing subsidies in the state-owned and the collectively-owned enterprises in 1990 were estimated as 358 and 50 Yuan per year respectively by the Study Group on China in JETRO (1993). Furthermore Shinya estimated standard housing rent as 1.56 yuan per 1 square meter per month (1991, p. 283.) Under the assumption that housing area per capita in urban areas is 15 square meter, housing rent is calculated as 280.8 yuan ($1.56 \times 15 \times 12$). According to our estimation, on the other hand, $W_{p3}/L_p = W_3/L$ is 390 yuan in 1980 and 521 yuan in 1985. The difference between our estimates and Shinya estimates comes from that the former includes benefits from utilizing various kinds of welfare facilities other than housing.

¹⁴ State Statistics Bureau 1993, p. 430.

The difference comes uniquely from the difference in welfare facilities (W_3/Y_p is 12.0% and 4.7% respectively): a proportion of non-production assets in total assets (K_n/K) is 20.7% in China, while 14.4% in Tianjin.

As far as over-time changes are concerned, the labor's share of income in China decreased in all three estimates (A, B and C) during 1980–85. It is unknown if this change is a part of the declining trend from earlier years or if this is a consequence of the fact that 1985 was a year of economic boom. In Tianjin the labor share showed a clearly increasing trend for 1985–1990 in all estimates. Among the three estimations, Estimation C (W/Y_p) showed the largest increase from 39.0% to 74.2% and Estimation B (W/Y) the smallest increase from 36.7% and 69.0%. This increase came from two sources; a component relating to cash wages and that to welfare payments. In Estimation C, for instance, W_1/Y_p increased from 27.7% to 52.5% and W_2/Y_p from 6.6% to 16.7%. (Component relating to welfare facilities W_3/Y_p was almost unchanged.) Thus we can state that the relative income share of labor rose dramatically since the mid-1980s due to increase in cash wages and welfare payments. As will be pointed out later, this phenomenon was caused by an introduction of the incentive system of wage determination.

In almost all estimates of labor share by other authors, it is defined and calculated as a proportion of cash wages in value added. For instance, Tajima obtained an estimate of 29.6% for all state-owned enterprises in Chinese industry¹⁵. This is almost comparable to our estimates of W_{p1}/Y_p , W_1/Y and W_1/Y_p . It should be noticed that the labor share is raised by about 10% by adding other components relating to non-cash payments. Tajima stated "Labor share is still kept at a low level," but we found that it began to increase rapidly thereafter.

There are only few examples of full-scale estimates. Here we are referring to two examples. The first is the estimates on the enterprises in Wuhan City in 1987 by Jefferson and Xu. They are ratios of all payments to workers to total amount of production: 16.6% for state-owned enterprises and 22.7% for collectively-owned enterprises¹⁶. Multiplying value added ratio (a ratio of value added to output) in this year to our estimates of labor share, we can get estimates comparable to Jefferson-Xu estimates. Adjusted figures are 16.8%, 15.8% and 18.5% respectively in Estimates A, B and C and show there is not a big gap between their estimation and ours. The second is the estimate by Liu, Murakami and Otsuka for the apparel industry in China in 1990. Their result is 80% both in state-owned and collectively-owned enterprises¹⁷, which is much larger than our estimates. This difference seems reasonable because the apparel industry is more labor-intensive than the machine industry.

II. *Estimation of Production Function*

Functional form of the production function

Considering the reliability of China's data for estimating production functions, we will use the Cobb-Douglas type function which is the most simple function of homogeneous of

¹⁵ Tajima 1991, p. 15.

¹⁶ Jefferson and Xu 1991, p. 56.

¹⁷ Liu, Murakami and Otsuka 1994, p. 143.

degree one. As stated in the previous sections, the factors used only for production purposes will be utilized for this estimation.

$$\ln \frac{Y_p}{L_p} = A + (1 - \alpha) \ln \frac{K_p}{L_p} + u \quad (1)$$

where Y_p represents the value of net output of an enterprise at the current prices, K_p the net fixed assets for production purposes at current prices, L_p labor force for production purposes, α the output elasticity of the net fixed assets, u stochastic shocks to production, A is a technology variable, and \ln represents natural logarithm.

The technology variable represents the efficiency level for each enterprise. It is modeled in the following way :

$$A = a_0 + \sum_1^3 a_i T_i + \sum_3^5 a_i S_{i-2} + a_6 \ln V + \sum_7^9 a_i S_{i-6} \ln V + \varepsilon \quad (2)$$

a_0 is a constant. Since the governmental regulations to enterprises differ by type of ownership, the efficiency level of an enterprise may vary depending on T_i which represents type of ownership. For state-owned enterprises, $T_1 = 1$ and $T_2 = 0$. In contrast, $T_1 = 0$ and $T_2 = 1$ for state and collective jointly-owned enterprises. When an enterprise is collective-owned, both T_1 and T_2 are zero. Also the efficiency level may differ from one sub-sector to another even in the machine industry and S represents a dummy variable for a sub-sector. In this case, S_1 , S_2 and S_3 are, respectively, for the general machine sector, for the electrical machine sector, and for the transportation machine sector. S_i has a value of unity for an enterprise in the respective sector and zero in other sectors. When an enterprise belongs to the precision machine sector, all S are zero.

V represents the intensity of fixed asset utilization. As a result of material and fuel rationing by the central and local governments, their availability determines the intensity of fixed asset utilization and the production efficiency. V is defined as the ratio of a value of materials and fuels to the net fixed assets, although the value of materials and fuels for 1980 is not available in *National Census*. In this case, the value is approximated to the figure created by subtracting wages from the costs of production which consists of materials, fuels, wages and indirect costs of production.¹⁸ The term $S_{i-6} \ln V$ represents that the availability of materials and fuels may vary depending on a sub-sector of the industry due to governmental rationing. ε is stochastic disturbances to the production efficiency.

Estimation results

Estimation results for equation (1) are shown in Table 3. Firstly, let us investigate coefficients of variable T_i type of ownership. In China, a_1 is statistically significant in 1980, but not in 1985. This result indicates that state-owned enterprises were more efficient than collective-owned ones in 1980. However, the higher efficiency of state-owned enterprises disappeared in 1985. As for a_2 , it is not statistically different from zero and the efficiency level

¹⁸ When we define C as the costs created by subtracting wages from the cost of sales of products and M as the material and fuel costs, the following equation can be estimated with the 1985 data of *National Census*.

$$\ln C = 0.556 + 0.887 \ln M \quad R^2 = 0.840$$

Because there is a close correlation between C and M , C can be used as an instrumental variable of M in estimating production functions.

TABLE 3. ESTIMATION RESULTS OF THE PRODUCTION FUNCTION:
THE MACHINE INDUSTRY

Data	Year	Const.	Ownership			Machine subsector			Intensity of utili- zation	Intensity of utiliza- tion and sector			Capital labor ratio	\bar{R}^2
			State	State and Collective	General	Electri- cal	Transpor- tation		General	Electri- cal	Transpor- tation	$\frac{K}{L}$		
												$1-\alpha$		
	a_0	a_1	a_2	a_3	a_4	a_5	a_6	a_7	a_8	a_9				
China	1980	0.638 (.275)	0.215 (.063)	0.069 (.103)	-0.574 (.077)	-0.618 (.077)	-0.673 (.081)	1.044 (.226)	-0.499 (.230)	-0.669 (.230)	-0.454 (.245)	0.464 (.069)	0.387	
	1985	0.614 (.196)	-0.002 (.045)	-0.118 (.073)	-0.286 (.054)	-0.250 (.055)	-0.330 (.057)	0.559 (.183)	-0.057 (.187)	-0.080 (.186)	0.025 (.190)	0.513 (.050)	0.568	
Tianjin	1985	0.408 (.227)	0.126 (.045)	0.241 (.123)	-0.384 (.310)	-0.376 (.305)	-0.603 (.331)	0.396 (.271)	-0.100 (.273)	-0.164 (.268)	0.052 (.282)	0.450 (.098)	0.332	
	1986	0.709 (.210)	0.019 (.045)	0.194 (.114)	-0.534 (.629)	-0.664 (.624)	-0.949 (.633)	0.065 (.640)	0.146 (.639)	0.155 (.635)	0.429 (.642)	0.521 (.081)	0.432	
	1987	1.021 (.284)	0.075 (.061)	0.304 (.157)	-0.980 (.835)	-1.064 (.830)	-1.531 (.862)	-0.239 (.759)	0.541 (.758)	0.540 (.753)	0.942 (.777)	0.424 (.106)	0.310	
	1988	1.360 (.261)	0.085 (.056)	0.225 (.146)	-1.395 (.874)	-1.486 (.869)	-1.825 (.889)	-0.617 (.812)	0.941 (.813)	0.998 (.810)	1.207 (.822)	0.502 (.091)	0.406	
	1989	0.089 (.238)	0.090 (.052)	0.266 (.141)	-0.120 (.785)	-0.073 (.781)	-0.320 (.799)	0.624 (.683)	-0.262 (.680)	-0.379 (.678)	-0.218 (.692)	0.512 (.080)	0.434	
	1990	-0.096 (.253)	0.081 (.056)	0.163 (.148)	-0.007 (.731)	0.050 (.728)	-0.403 (.749)	0.817 (.699)	-0.444 (.697)	-0.566 (.695)	-0.298 (.709)	0.570 (.083)	0.446	

Notes: 1) The figures in parenthesis are a standard error of coefficients.

2) The numbers of observation are 389 and 129 for *National Census* and *Tianjin Survey*, respectively.

Sources: *National Census* and *Tianjin Survey*.

of state and collective jointly-owned enterprises did not differ from that of collective-owned enterprises. In Tianjin, a_1 is significant only in 1985, but a_2 is statistically significant in every year except 1990. This result shows that the efficiency level of state and collective jointly-owned enterprises is higher than that of other ownership types. Liu, Murakami and Otsuka (1994) also report the similar result for the apparel industry.¹⁹

In China, a_3 , a_4 and a_5 , coefficients of variable S , are negative and statistically significant in both 1980 and 1985 estimation. The negative estimates of these coefficients indicate that the efficiency level is significantly higher in the precision machine sector than in other ones. Yet, a decline in absolute values of these coefficients implies that the efficiency gap between the precision machine sector and other ones became smaller. In Tianjin, a_3 , a_4 and a_5 show the similar results to those for China, but a decline in the efficiency gap is not observed.

In both the 1980 and 1985 estimation using data from *National Census*, positive and statistically significant a_6 indicates that more intensive utilization of the fixed assets leads to a higher level of efficiency. At the same time, the decreasing value of a_6 from the 1980 level implies that the intensity of the fixed asset utilization did not differ greatly from one enterprise to another in 1985. In Tianjin estimates, a_6 is not statistically significant. This result implies

¹⁹ Liu, Murakami and Otsuka 1994, p. 147 and p. 150.

TABLE 4. OTHER ESTIMATES OF THE OUTPUT ELASTICITY OF LABOR

Type of data	Economists	Type of enterprise	Year	Output elasticity of labor
Cross-section	<i>Doller</i> ^a	State-owned	1982	0.62
	<i>Jefferson</i> ^b	Heavy industry	1984	0.476
		Light industry	1984	0.462
	<i>Jefferson</i> ^c	Iron and steel	1986	0.523
	<i>Jefferson et al.</i> ^d	State-owned	1984-87	0.369
		Collective-owned	1984 and 1987	0.478
	<i>Liu et al.</i> ^e	State-owned in apparel	1990	0.37
		Collective-owned in apparel	1990	0.40
Time-series	<i>Chen et al.</i> ^f	State-owned	1953-85	0.458
	<i>Prime</i> ^g	State- and collective-owned in Jiangsu	1980-88	0.264

Note: d) Because the gross output elasticity of labor is estimated in this study, the output elasticity of labor is calculated in the following way.

$$\alpha = \frac{\text{gross output elasticity of labor}}{\sum \text{gross output elasticities of labor and capital}}$$

For collective-owned enterprises, an average value is calculated from the 1984 and 1987 estimates.

- Sources: a: *Doller* 1990, p. 96.
b: *Jefferson* 1989, p. 49.
c: *Jefferson* 1990, p. 336.
d: *Jefferson, Rawski and Zheng* 1992, p. 251.
e: *Liu, Murakami and Otsuka* 1994, p. 143.
f: *Chen, Wang, Zheng, Jefferson and Rawski* 1988, p. 580.
g: *Prime* 1992, p. 37.

that there is only a small variation in fixed asset utilization levels and this may be explained by the locations of Tianjin enterprises within rather narrow limited areas. In this case, the availability of materials and fuels will not differ greatly from one enterprise to another and a variation in the fixed asset utilization levels becomes very small.

Coefficients a_3 , a_4 and a_5 for variable $S_{i-6} \ln V$ are negative and statistically significant for the 1980 data in *National Census*, but they are not significant for the 1985 data. In the data from *Tianjin Survey*, these coefficients are not statistically significant in every year. These results imply that the intensity of the fixed asset utilization did not differ among sub-sectors except in 1980.

Coefficient $1 - \alpha$, the output elasticity of net fixed assets, is statistically significant at both the national level in China and the local level in Tianjin. Hence, coefficient α , the output elasticity of labor force, is calculated and shown in the last column of Table 1. In 1985, China's

α is slightly smaller than that of Tianjin. This is a reflection of higher capital-labor ratio for all of China than in the city of Tianjin. In the former the ratio is 7,650 yuan per worker, while in the later it is 6,730 yuan per worker.²⁰ During the 1985–87 period, any kind of time trends for changes in Tianjin's α cannot be seen. Yet, Tianjin's α decreased significantly from 1987 and this decline indicates that the production technology of China's machine industry became more capital intensive in the latter half of the 1980s.

Let us compare our estimation results of α with other recent studies. As shown in Table 4, α differs slightly depending on the data for estimation. Although our results are quite similar to those of others, there are some studies, such as Doller's whose estimate is significantly larger than ours, and Prime's whose estimate is smaller than ours. These significantly different estimates occur for the following reasons: (1) because the former estimate is based on only 20 large enterprises in that no money-losers were included, the estimate is not a real representative of state-owned industry; and (2) because collective-owned enterprises produced over half of total industrial output until the mid-1980s in Jiangsu province, the estimate is likely to be smaller than that for state-owned enterprises.

III. *Comparison of Labor Share with Output Elasticity of Labor: Evaluation of an Incentive System for Workers*

Comparison of labor share with output elasticity

Let us compare Estimation A of labor shares with the output elasticities of labor in Table 1. In this comparison, there are two important points to be mentioned. The first point is that the labor shares are smaller than the output elasticities in China and also in Tianjin during the 1985–87 period. The other point is that Tianjin labor shares show an increasing trend throughout the period studied, whereas its output elasticities of labor show a decreasing trend in the 1987–90 period. As a result, the labor share became larger than the output elasticity of labor in 1988 and after that the gap between the two widened. When a labor market is competitive, a labor share will become equal to an output elasticity of labor theoretically and a gap between the two will get smaller.²¹ Our finding is obviously different from Jefferson and Xu's findings (1987) with Wuhan enterprises. Their study shows that a labor share was equal to an output elasticity of labor and concludes that the labor markets were very competitive even in China.²² However, our estimates show that the labor markets were not competitive in China. A similar result was also obtained in the apparel industry in Liu, Murakami and Otsuka's study.²³

We have to investigate the reasons why the labor share became smaller than the output elasticity of labor since 1987. This depends partly on China's governmental wage policy. The

²⁰ The major reason why the capital-labor ratio was higher in China than in Tianjin is as follows: The figures in the *National Census* are obtained only from large-and medium-scale enterprises, whereas the figures in *Tianjin Survey* include small-scale enterprises' data. Also see Note 11.

²¹ In Hondai's estimates for Japan's manufacturing industry, the labor shares are almost equal to the output elasticities of labor (1992, p. 101 and pp. 130–133).

²² See Note 16.

²³ See Note 17.

government artificially determined the wage levels of factory workers after classifying them by occupation.²⁴ Although the base of their wage levels is not clear for us, the levels were determined at a point which enabled enterprises to make profits, a major source of the governmental revenue. To maximize profits for enterprises, the base was kept as low as possible. This was feasible because a large number of surplus labor existed in the rural areas. On the other hand, the governmental employment policy which is reflected in the labor appointment will push up the labor share. The low labor share in this period implies that an effect of the employment policy was weaker than that of the wage policy.

Factor which raised labor share

As shown in Table 1, the labor share became larger than the output elasticity of labor in the 1988–90 period. We think that this phenomenon originated from the changes in China's wage policy. The wage system before introducing the economic reforms did not evaluate the worker's efficiency nor his efforts in the work place, but were instead determined seniority. As the government thought that this system did not provide any incentives to work harder and led to a low growth rate in China's manufacturing industry, it started to introduce a new wage system which would provide work incentives for workers and managers. When the profit tax was introduced in place of paying entire profits to the governments in 1984, the enterprises were given more freedom of making their own decision and introducing an incentive wage system.²⁵ In the system, 50 percent of the enterprises' profits after-tax has to be invested into the expansion of production facilities. Of the other 50 percent, 20 percent is allocated for welfare expenditures and other 30 percent for worker bonuses. Moreover after introducing the management responsibility system in 1987, the government implemented a policy to increase bonuses and welfare expenditures regardless of profits.²⁶ As result, the wages per worker grew faster than labor productivity and the labor share also increased significantly. As shown in Figure 1, the growth rate for wages per worker was lower than that of labor productivity in China until 1985. However, after 1985, the wages per worker in Tianjin grew steadily even though labor productivity stagnated.

To investigate the above changes, we will analyze the movements of the wages and profits, using the following equation.

$$W_c = a_0 + a_1 R + a_2 L + u \quad (3)$$

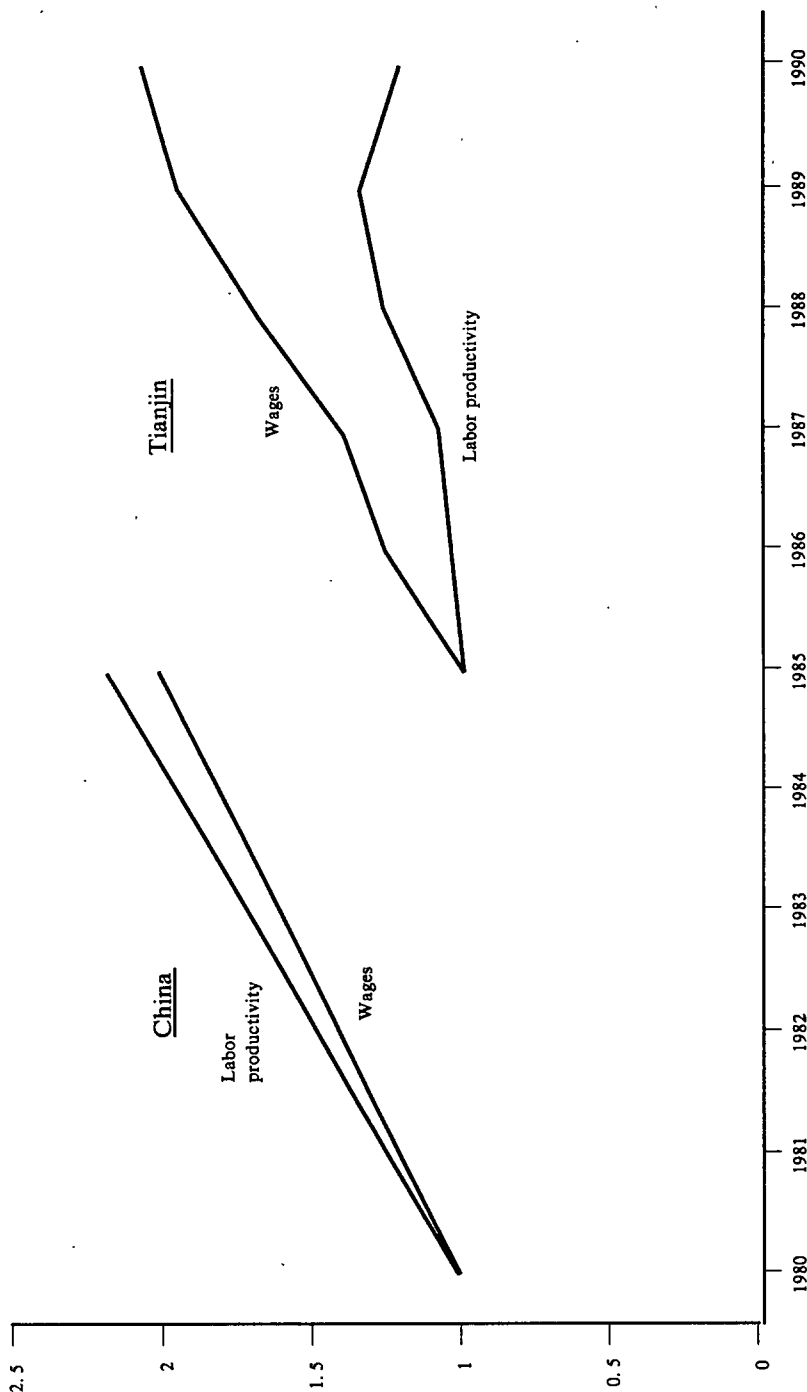
where W_c is the wages paid in cash ($W_1 + W_2$), R profits (these are *a priori profits* which include bonuses and welfare expenditures), L labor force, and u stochastic shocks. With the data from *National Census* and *Tianjin Survey*, equation (3) is estimated and the results are shown in Table 5. Coefficients a_1 and a_2 are statistically significant in every year. On the bases of the estimated coefficients, the wage elasticity with respect to profits and the labor force (in short, the profit elasticity and the labor elasticity, respectively) is calculated and shown on the last

²⁴ As for China's wage and employment systems, see Kojima 1991 and Kizaki 1993.

²⁵ The first phase of the *profit tax* was implemented in 1983 and then its second phase in 1984. In the second phase, the upper limit of bonus payments was removed and a tax for bonus was introduced to the bonus payments which exceed a certain level (Yabuki 1992, p. 74).

²⁶ As for the management responsibility system, see Minami 1990, pp. 41–42, and Japan and China Economic Association 1989, pp. 2–5.

FIGURE 1. WAGES PAID TO A WORKER AND LABOR PRODUCTIVITY: THE MACHINE INDUSTRY



Notes: 1) Wages paid to a worker = W_t/L_t . Labor productivity = Y_t/L_t . 1980 = 1.00 for China and 1985 = 1.00 for Tianjin.
 2) Because wages defined by W/L and productivity defined by Y/L are almost same as W_t/L_t and Y_t/L_t respectively, they are not shown in this figure.

Sources : *National Census* and *Tianjin Survey*

two columns in Table 5. The labor elasticities are almost unity for the period studied. This fact indicates that the wages paid to workers increase by one percent as the number of workers employed increase by one percent. In 1980, the profit elasticity was almost zero, which implies that an increase in profits did not raise the total wages paid to workers. Yet the profit elasticity became larger in 1985 and an increase in profits began to affect the total wages paid to workers. In 1987, it went up to an even higher level which coincided with the introduction of the management responsibility system.

The traditional employment system is another factor which raised the labor share. As shown in Table 6, *Tianjin Survey* indicates that 102 out of 142 enterprises stated that the most important method of job placement was the governmental appointment in 1990. Among the other 40 enterprises, 30 enterprises stated that the governmental appointment was the second important method. A more detailed examination by type of ownership shows that the governmental appointments are naturally the most important for state-owned enterprises. Out of 91 state-owned enterprises, 71 stated that it was the most important method of hiring new employees. Among collective-owned enterprises, 26 out of 44 enterprises stated that the governmental appointments were the most important method. Even among Chinese and foreign jointly-owned enterprises, 3 out of 4 enterprises answered that it was the most important method.

An introduction of the incentive wage system led to an increase in labor share through the larger wage payments and an expansion of welfare expenditures. In most of enterprises, this led to serious financial difficulties. As shown in Figure 2, the rate of returns (C) estimated as $(Y_p - W)/K_p$, for instance, declined sharply from 1.43 to 0.63 in the 1985–90 period.²⁷ Moreover, the number of enterprises with losses in 1985 were only 3 out of 129 enterprises, in 1990 this number had increased to 25. Our analysis obviously shows that the increases in wages due to an introduction of the incentive wage system was a burden for the enterprises.²⁸

IV. Summary and Conclusion

The analyses in this paper are based on partly our survey of the 1985–90 Tianjin machine industry and partly on *National Census* for 1980 and 1985 data. Firstly, we calculated labor shares of output in detail by estimating the wages paid in kind. As analyzed in Section 1, our findings show that our estimates of labor share are larger than the labor shares of other studies which were based only on the wages paid in cash. Our findings also show that the labor shares increased remarkably in the latter part of the 1980s. Secondly, we estimated the output elasticity of labor by estimating production functions of the machine industry. Our estimation

²⁷ As for the rate of returns to the net fixed assets, we found that it was higher in Tianjin than in China. This difference was mainly originated in a smaller labor share and a lower capital-output ratio in Tianjin's enterprises. Moreover, the smaller capital-output ratio was originated from the smaller capital-labor ratio (also see Note 20). The reasons why the rates of returns in Figure 2 are higher than those listed in the *Statistical Yearbooks of China* are as follows: (1) because our rate of returns is the arithmetic mean of individual enterprise figures, small enterprises whose rate of returns is usually higher than that of large enterprises are given larger weight in its calculation; and (2) our definition of rate of returns is different from that in the *Statistical Yearbooks of China*.

²⁸ Du and Shang describe that the spending on welfare in state-owned enterprises had expanded due to employees' pressure since 1985 despite a decline in their economic efficiency (Du and Shang 1993, p. 50). Our conclusion is same as theirs.

TABLE 5. ESTIMATION OF WAGE FUNCTION:
THE MACHINE INDUSTRY

Area	Year	Const.	Returns (R)	Worker (L)	\bar{R}^2	Elasticity	
		a_0	a_1	a_2		R	L
China	1980	-155.6	0.002 (.0008)	0.928 (.006)	0.99	0.008	1.044
	1985	-246.3	0.009 (.001)	1.339 (.011)	0.99	0.036	1.011
Tianjin	1985	-934.2	12.07 (.162)	0.110 (.021)	0.99	0.040	1.033
	1986	-205.0	13.63 (.171)	0.285 (.018)	0.99	0.080	0.933
	1987	-1180.8	15.93 (.350)	0.483 (.033)	0.98	0.122	0.940
	1988	-2446.5	20.20 (.457)	0.624 (.052)	0.98	0.131	0.973
	1989	-4317.7	25.07 (.637)	1.137 (.133)	0.96	0.127	1.029
	1990	-3532.3	26.24 (.330)	1.342 (.054)	0.99	0.107	1.012

Notes: 1) The figures in parenthesis are a standard error of coefficient.

2) The numbers of observation are 389 and 129 enterprises for China and Tianjin, respectively.

Source: National Census and Tianjin Survey.

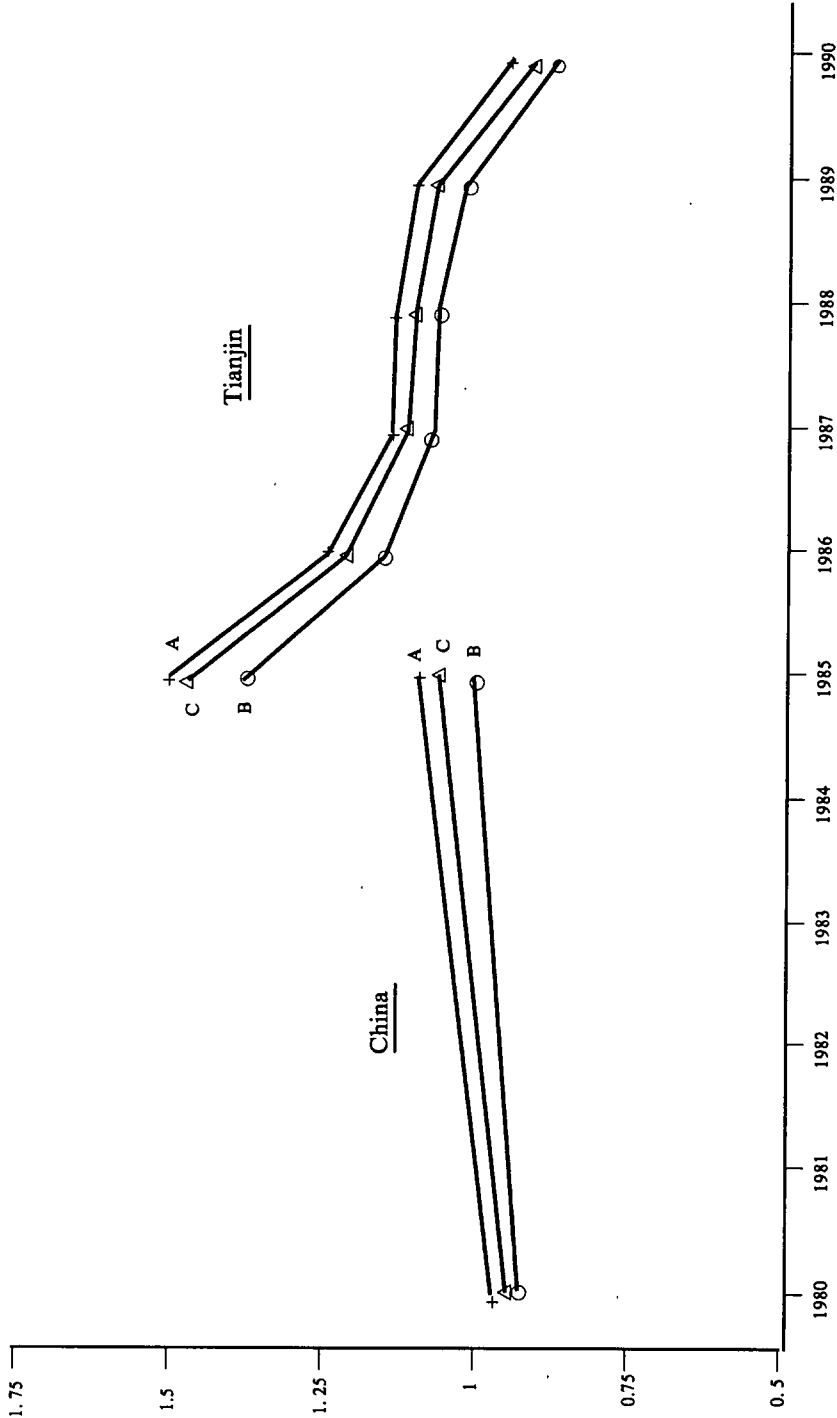
TABLE 6. HIRING SYSTEMS FOR WORKERS:
TIANJIN MACHINE INDUSTRY

	Government appointment	Contract system	Other	Total
State-owned	71	18	2	91
Collective- owned	26	14	4	44
State and collective jointly-owned	2	1	0	3
China and foreign jointly-owned	3	1	0	4
Total	102	34	6	142

Note: The figures are the number of replies to the question, "what is the most important hiring method of workers for an individual enterprise?"

Source: Tianjin Survey.

FIGURE 2. CHANGES IN THE RATE OF RETURNS TO FIXED ASSETS: THE MACHINE INDUSTRY



Notes : A = $(Y_t - W_t) / K_t$, B = $(Y_t - W_t) / K_t$, C = $(Y_t - W_t) / K_t$.
Sources : National Census and Tianjin Survey.

shows that it declined gradually in contrast with the increasing trend of labor share as analyzed in Section 2. A comparison between labor share and output elasticity in each year shows that China's labor markets were not at an equilibrium. Until 1987, the labor share was smaller than the output elasticity of labor and this smaller labor share might have originated from the government control of wage levels. However, since 1988 the former has become larger than the latter and the gap between the two has been increasing. This larger labor share is mainly a result of the incentive wage system introduced in the mid-1980s which allocated a large share of profits to the wages and which raised the wage rate levels. A deterioration in the financial situation of enterprises is a result of a substantial decline in rates of returns to the fixed assets.

Let us summarize why China's economic reform with respect to state- and collective-owned enterprises did not work well. There are two important reasons to be mentioned. The first one is that the economic reform cannot be implemented thoroughly without changing the ownership of enterprises. When the state-owned enterprises suffer losses, the government still tries to carry these losses even after an introduction of economic reforms. Given this situation state-owned enterprises do not make great efforts to realize profits. The minds of managers in some state-owned enterprises changed slightly in the process of economic reforms during the 1980s and although a competition among enterprises increased,²⁹ the way of thinking in the planned economic system still persists among many managers.³⁰ The other reason is that the labor markets have not well developed yet. In state-owned enterprises, the number of employees was basically determined by the government and appointments of new graduates to state- and collective-owned enterprises did not cease, even after the implementation of the economic reforms. On the other hand, since the mid-1980s enterprises acquired more freedom to increase bonus payments and also more freedom to hire contract-workers in the new contract-worker hiring system. However, once they employ contract-workers, they are not able to fire the workers. As a result, these contract-workers remain in the enterprises as if they are employed in the life employment system. Under these conditions, it seems inevitable that the level of wages per worker exceeds the productivity level in state-owned enterprises.³¹

To free from this trap, China has to change the ownership of enterprises from the governments to the legal corporations. In extreme case, privatization of state-owned enterprises has to be considered. Also the appointment of workers to enterprises by the governments should be stopped and the wage rate should be determined by labor markets. Since it is expected that a large number of workers may lose jobs in this system, it is inevitable that the government must establish social security systems which will prevent social unrest.

HITOTSUBASHI UNIVERSITY

²⁹ This point is also emphasized in Chen 1988; Jefferson, Rawski and Zheng 1992.

³⁰ Based on his questionnaire, Zheng concludes that there were still governmental interventions into markets and enterprises' activities (Zheng 1992).

³¹ As for the situations and problems of China's labor markets, see Minami 1990, pp. 216-8.

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